The Move Towards Riskier Pension Products in the World's Best Pension Systems

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Abstract

The Danish and Dutch pension systems are often referred to as "among the best in the world". In this paper we compare pension systems and pension products in Denmark and the Netherlands. We focus on the shifts that are taking place in both countries, from pension products with relatively low levels of risk for pension scheme members to pension products with more risk but also higher expected return. We also present the results of a case study where customers were given the chance to shift from a low-risk to a higher-risk product. We end out drawing lessons that are relevant for discussions in many countries.

Samenvatting

Transitie naar variabele pensioenproducten in 's werelds beste pensioenstelsels: Een vergelijkingsstudie tussen Nederland en Denemarken

We vergelijken de Deense en Nederlandse pensioenstelsels en pensioenproducten. Hierbij richten we ons op de overgang van pensioenproducten met relatief weinig risico voor de deelnemers naar pensioenproducten met meer risico en dus ook een hogere verwachte uitkering. We bekijken de recente Nederlandse wetswijziging waardoor het mogelijk is, binnen premieregelingen, voor meer risico en rendement te kiezen via variabele uitkeringen. In Denemarken heeft in het afgelopen decennium een overgang plaatsgevonden van uitkeringen met een minimale rendementsgarantie naar producten zonder garantie. De opgedane ervaring leert ons dat het verstandig is om eerst regelgeving vast te stellen alvorens de overgang te laten plaatsvinden. Tevens presenteren we de resultaten van een casus waarbij deelnemers de keuze werd gegeven om over te schakelen van een product met laag risico naar een met hoog risico. Dit toont aan dat mannen met weinig pensioenvermogen en lage garanties die in steden wonen, bereid zijn om die garanties op te geven voor grotere kansen. Zodra de garanties zijn opgegeven, is het vanuit communicatief oogpunt aan te bevelen om de deelnemers niet alleen te informeren over de verwachte hogere pensioenuitkering maar ook over de toename in onzekerheid. Gegeven dat beide onderzochte stelsels hoog aangeschreven staan, kunnen deze bevindingen ook relevant zijn voor andere landen dan Denemarken en Nederland.

1. Introduction

The Dutch and Danish pension systems are frequently referred to as "the best in the world" (Mercer, 2017). This is due to the amount of pension savings in Denmark and the Netherlands, the corporate governance of pension providers, the robustness of pension systems, and more. Measured in relation to GDP, private pension savings in the Netherlands and Denmark are the highest in the world. However, in spite of the size of pension savings, the Danish and Dutch pension systems also face challenges. These challenges are due in particular to the current low-interest-rate environment coupled with increasing life expectancy. Low interest rates and longer life expectancies make it challenging for pension providers to honor pension promises (or even guarantees). As a consequence, the Dutch and Danish pension sectors have undergone and continue to undergo considerable changes.

In the Netherlands, most private pensions are Defined Benefit (DB) plans.[1] Although the percentage of fully Defined Contribution (DC) plans in the Netherlands is low, DC-plan design is actively discussed in the Netherlands within the context of broad pension system reform.[2] In addition, a new law was implemented in 2016 that allows for risk-taking in DC plans through investment in risky assets as opposed to strictly risk-free exposure. Therefore, risk exposure is now possible not only during the accumulation but also the decumulation phase, in the hope of harvesting risk premiums. These are called *variable*, i.e. risky, annuities. Previously, pension wealth at retirement had to be converted into a fixed annuity that would no longer be exposed to risky financial markets. In Denmark, contrary to the Netherlands, most private pensions are DC plans. Typically, pensions savings were in guaranteed products, i.e. the capital in the DC account, both in the accumulation and the decumulation phase, was guaranteed to increase by a certain minimum return. During the past decade, however, Danish pension holders have shifted from guaranteed pension savings to non-guaranteed savings. The main driving forces behind this shift have been the increased capital requirements under Solvency II plus the fundamental idea that allowing for more risk will lead to higher returns.

1 As we discuss further in the paper, the current pension system in the Netherlands does not consist of DB plans in its strict sense, but rather of a combination of DB and DC.

2 The Dutch government coalition has stated that the Personal Pensions with Risk-sharing PPR with collective buffers as described in Bovenberg and Nijman (2017b) will be the core of the new legislation. This product shares many characteristics with DC plans. See also Bovenberg and Nijman (2017a, 2017b) for the recently developed design of the total reform.

When interest rates are low, pension guarantees induce pension providers to invest mainly in safe assets so as to be able to fulfill guarantees in DC schemes and to honor promised benefits in DB schemes. Safe investments ensure that pensions are paid out, but since the returns from these investments are low, pensions will be low as well. In non-guaranteed pension schemes and variable annuities, pension providers can invest more in risky assets and harvest the related risk premium, thereby generating higher expected returns. This is obviously at the cost of pensions becoming more risky.

As a result of these developments we see a process starting in the Netherlands that allows pension holders to shift from relatively safe products to risky products, or at least one in which the risks are made explicit, both in the sense of identifying the risk-bearer (employee versus employer) as well as the increased potential for extra returns. In Denmark this process was started some years ago. These fundamental changes call for a comparison of the two systems. Perhaps the Netherlands can benefit from what the Danish transition has taught. On the other hand, Dutch pension projections have been surrounded by confidence bounds, something that has not been the case in Denmark. Could Denmark learn something from the Netherlands here? The scope of this paper is to compare Danish and Dutch pension systems, focusing on the shift from safe to more risky products that takes place in the two countries. The insights on how to structure risk taking or guarantees in the pay-out phase of DC plans, which are summarized in this paper, are likely to be relevant for the current Dutch pension reform debate. Given the well-developed nature of pension systems in Denmark and the Netherlands, these learnings should also be relevant for other countries that are thinking about how to design their pension systems.

In order to understand the situation of both the individual, who needs to decide which pension product to invest in, and the regulatory viewpoint on how pension system transition has taken and still takes place, we first describe the general pension sectors and the design of the products in the Netherlands and Denmark. We find that at macro level, the Dutch and Danish pension systems have many similarities. For instance, both countries have large pension sectors, they both face higher life expectancy, and their old-age dependency ratios are expected to increase.

The main part of this paper focuses on pension products. We see some important differences between Denmark and the Netherlands in this regard. As already mentioned, the most important difference between the Dutch and Danish pension sectors is the widespread use of DB plans in the Netherlands, while these are almost

non-existent in Denmark.[3] Another interesting dimension is that different pension savings dimensions seem to be discussed in the two countries. In the Netherlands, the new legislation focuses on risks in the decumulation phase in DC plans, although the current discussion implies a total reform resulting in a shift from "DB" to DC. In Denmark, the discussion focuses on risks in the accumulation phase, i.e. there was and will continue to be a DC framework, but return guarantees are altered. In DB plans, the issue is about how the benefits are formed, and thus the uncertainty that surrounds these. In DC plans, the issue is about the return that the contributions can generate.

In addition to comparing the pension products and the related discussions in the Netherlands and Denmark, we analyze a case study where pension holders were allowed to switch from a guaranteed to a non-guaranteed product. The case involves a medium-sized Danish pension fund that gave its pension holders the opportunity to make such a switch in 2007. We found that in particular younger men living in Copenhagen, the capital and largest city in Denmark, with a pension product with a low guaranteed return and relatively low pension wealth were more likely to switch. These findings tell us which pension holder category is more likely to switch to a product involving higher risk, and thus possibly a higher expected return, when given the chance to do so.

We wish to note that, when this paper speaks of "risky pension products", it is implicitly understood as referring to risks for the customer. A shift from a guaranteed to a non-guaranteed product typically lowers the risk of insolvency of the pension provider, but as a consequence it increases the risk for the customer with respect to returns from pension savings. It is the latter effect that we refer to when discussing "increases in risk".

1.1 International transition to variable annuities

Transitions similar to those in Denmark and the Netherlands, from guarantees or DB plans to non-guarantees in the form of variable annuities, are taking place in a number of countries. In this section, we briefly discuss several recent developments in national pension reforms that have motivated our analysis.

In Switzerland, interest rate guarantees go back as far as 1985. The minimum return guaranteed has decreased from 4% to 1.25% in the last several decades. In Belgium, the average guaranteed rate of 3.5% has been transformed into variable

3 The Dutch DB can be regarded as a collective DC plan in which employers bear less risk than in a purely DB plan. The guarantee of the DB part is weak as the promise can be adjusted depending on the financial situation.

rates that are tied to current yields, this in order to increase the sustainability of the Belgium pension system (Devolder and De Valeriola, 2017). Bovenberg (2012) has compared the Dutch and Danish pension systems in general. Our own focus is more specifically on the move from safe, guaranteed products to risky, unguaranteed products in the Netherlands and Denmark. The Dutch variable annuity is described in the paper of Balter and Werker (2017). Jørgensen and Linnemann (2012) have described three variable pension products, for which they compared both the accumulation and decumulation phases, and explained in detail the interest rate guarantee, the most common pension product in Denmark. Bruhn and Steffensen (2013) derived for which type of preferences the Danish interest rate guarantee is the optimal product design.

In Latin America (Pennacchi, 1999), relative rate-of-return guarantees became common since the major transform from a DB to a DC system in the late 1980s. Garcia Huitron and Rodriguez-Montemayor (2017) discussed the debate for a reform of the current DC setting to more target-based investments. Variable annuities are still uncommon in Latin America, although variable annuities in combination with a minimal pension guarantee have been allowed in Chile since 2004 (Rocha et al., 2011). Japan followed the evolution in the US concerning the guarantees embedded in the variable annuity, since the financial deregulation in 1999 (Zhang, 2006). Also in China, variable annuities have regained interest since 2008. This caused Chinese policymakers to proceed with the development of regulations for these products. See Matterson (2017) for more information on retirement in the Asian market.

In the US, fund-linked annuities were introduced in the 1970s, and in the 1990s a wide variety of guarantees were added to these variable annuities. The recent financial crisis caused solvency issues for some providers (Forsyth and Vetzal, 2014). In combination with inefficient hedging strategies, these losses were largely due to the high option values. The most common guarantees embedded in variable annuities in the US are guaranteed minimum death benefits (GMDB) and guaranteed minimum living benefits (GMLB), where the latter can be subdivided into guaranteed minimum accumulation benefits (GMAB), guaranteed minimum income benefits (GMIB), and guaranteed minimum withdrawal benefits (GMWB). Bauer, Kling and Russ (2008) constructed a universal framework to price these guarantees.

Japan, Canada and the Netherlands only had 4.2%, 4.6% and 5.8% respectively in DC assets in 2016 (see Global Pension Assets Study 2017, Willis Towers Watson). In Canada, regulations on annuities within DB plans and regulations on the conversion to a larger reform have been developed lately (Warshawsky, 2013). The enhanced Canadian Pension Plan is being implemented as of now.

In Sweden, DC plans have covered the vast majority of pension schemes since 2007 (after 12 years of negotiation), similar to the current situation in Denmark. At retirement, pension holders can choose between converting the pension into a fixed annuity (to avoid investment risk) or a variable annuity. The variable annuity reflects the same mechanism as the Dutch product described in this paper, implying that the customer can opt for an annuity in which the fund continues to hold risky investments. These annuities do not have a guaranteed value (OECD, 2015). Individual pension accounts were introduced gradually starting in the late 1990s, and, similar to the Danish case, individuals were able to choose a fund. Engström and Westerberg (2003) and Palme et al. (2007) investigated the decision-making process and found that individuals with higher education and higher income, who are married and under 42 years, were more likely to make an active choice (Palmer, 2004). In Sweden, 85% chose the variable annuity, reflecting both variable financial returns and mortality rates, rather than the fixed annuity. Rivera-Rozo (2009) described the presence of variable annuities in Australia, Chile, Sweden, the UK, and the US up to 2009. Rusconi (2008) also described several national annuity markets. Of all individuals participating in the total Australian annuity market in 2000, who did not take their pension wealth out as a lump sum, 71% chose variable annuities without protection against longevity risk, 20% chose for variable annuities with a fixed horizon, and 9% went for variable annuities with protection against mortality risk. Allocated annuities without protection increased to almost 100% of the market from the late 1990s to 2012, while the relation between lump sums and annuities went from almost 80% to an equal split (Asher et al., 2013). Variable annuities were introduced in the UK in 2006, including additional minimum growth rate guarantees on the payout. These additional guarantees put providers under pressure during the recent crisis.

In many countries, low interest rates and low mortality rates have thus put many large pension systems under pressure, leading to discussion and reform. Variable annuities, i.e. non-guaranteed unit-linked products and DC-style plans, seem to be popular following the recent crisis. In this paper, we compare the changes in Denmark and the Netherlands in more detail, and we draw lessons regarding communication about risk and return, rules and regulations, and supervision. These lessons apply to many other countries since the Danish and Dutch pension systems, which are regarded as among the best in the world, reflect two "extremes" in that the former involves an almost strictly DC setting while the latter reflects a more DB-like setting. In addition, in Denmark the transition to non-guaranteed products took place some time before the change in the Dutch DC plans. Moreover, no consensus on a broader reform has been found yet in the Netherlands.

We have structured our paper as follows. In Section 2, we describe the pillars of the Dutch and Danish pension systems. In Section 3, we discuss and describe the introduction of variable annuities in the Netherlands. This is followed in Section 4 by a description of the transition from guaranteed to non-guaranteed pensions in Denmark, including an analysis of which pension holders switch from guaranteed to non-guaranteed pensions. In Section 5 we discuss the learnings. Conclusions are contained in the final section.

Table 1. Overview of pillars in the Dutch and Danish pension systems.

Pillar 1 State Pension Scheme	Pillar 2 Occupational Pension Schemes	Pillar 3 Private Benefit Plans
	The Netherlands	
Old Age Pension	Defined Benefit Defined Contribution	Defined Contribution
	Denmark	
Old Age Pension Civil Service Pension (Defined Benefit)	Defined Contribution	Defined Contribution

2. Pension savings and pension systems in the Netherlands and Denmark

The pension systems of both the Netherlands and Denmark consist of three pillars, as shown in Table 1. In the Netherlands, the first pillar accounted at the end of 2013 for 54% of pension entitlements, while the second pillar accounted for 40% and the third pillar for 6% (Bruil et al., 2015).

The first pillar provides a pension irrespective of the individual's working history. The right to a full state pension is conditioned on the requirement that the individual must have lived or worked for at least 50 years in the Netherlands. In Denmark, the full right to the state pension is obtained after 40 years of residence. This "full right" in Denmark is the right to a basic amount plus a means-tested supplement. The Dutch old-age pension (AOW) is not means-tested and is based on the PAYGO (pay as you go) system. In the Netherlands as well as in Denmark, state pension contributions depend on income levels through tax payments, but these contributions are not added to an individual account.[4]

The second pillar consists of work-related pension plans. This pillar is funded by both employees and employers. In both the Netherlands and Denmark, about one third of the contribution is paid by the employee and two third by the employer. In the Netherlands, the pension premium with respect to the second pillar is about 20% of gross pensionable income minus the state pension offset, implying a contribution of about 10% of gross income. In Denmark, the premium depends on whether a person is publicly or privately employed, although the contribution rate is generally higher for public employees; private employees started contributing later than public

4 In Denmark, the first pillar also includes a compulsory funded DC scheme, called ATP. This covers basically all wage earners. The contribution rates are relatively small, and therefore this scheme cannot in itself ensure a sufficiently high supplement to the publicly funded pensions. We therefore leave it out of the overview in Table 1.

employees. Neither in Denmark nor in the Netherlands is the pension premium allowed to depend on age or gender. This is known as a uniform contribution system. Pension premiums are tax deductible, and no tax is paid on a person's pension wealth. However, pension payouts are subject to tax. Moreover, government and employers facilitate a large second pillar through mandatory agreements for many industries. Therefore, the participation level is very high. More than 90% of employees in both countries belong to a pension fund.

The third pillar consists of voluntary individual pension plans. These are tax-effective compared to savings products that are not retirement-related. To be tax-effective, pensions have to be lifelong in the Netherlands[5]. In Denmark one can decide to take out a part of pension savings as a lump sum and use the remainder to finance a lifelong annuity.

2.1 Defined Benefits and Defined Contributions

One motivation for this specific paper is the introduction in the Netherlands of the Premium Schemes (Improvement) Act (*Wet verbeterde premieregeling*). This applies to the defined contribution (DC) plans in the second and third pillars. Since only 5.8% of Dutch entitlements involved a defined contribution, while 94.2% constituted defined benefits (see Global Pension Assets Study 2017 by Willis Towers Watson), the new law applies directly to only a small fraction of the pension plans. However, a transition is going on towards more DC plans in the Netherlands. In addition, relaxation of guarantees is currently being discussed for the DB plans as part of an overall reform of the pension system. The other motivation for this paper is the recent shift from guarantees to non-guarantees that Denmark went through.

Defined Benefits

In abstract terms, a defined benefit plan (DB) defines the benefits to be received. In the Netherlands, future pension payments are promised upfront (in conditional terms, based on the life expectancies applied and the financial situation of the pension fund) and contributions are defined too, so that the result combines DB and DC characteristics. Nevertheless, it is officially categorized under the label of "DB". In 2008, 88% of Dutch active employees had a DB plan and 5% a DC plan. The remaining 7% consisted of a mix of regulations and plans (Statistics Netherlands). Note that DB contracts in the Netherlands are de facto collective defined contribution

5 Note that there is an exception for a small market in the Netherlands, bank savings with at least 20 year income are also entitled to tax beneficial rules.

(CDC) contracts. If a pension fund lacks capital (i.e. the assets of the fund are insufficient to meet the liabilities), then in a strict DB plan the employers bear the risk, meaning that they have to provide sufficient funding. However, in the Netherlands the contributions stay constant in such a situation and the pension payments are reduced according to a supervised recovery plan. This means that the risk is borne by the employees. The CDC plan thus combines the (conditional) guarantee of the pension payments with fixed contributions. This means that it has both DB and DC characteristics. If the contributions turn out to be insufficient, then the future pension rights linked to the premium will be decreased. Therefore, a purely DB plan does not describe the current Dutch system accurately, although the design and non-existence of hard guarantees only surfaced when several pension funds had to cut their benefits in April 2013 (Bovenberg et al. (2015)). The benefits are indexed or cut based on the funding ratio of the pension fund. The funding ratio is influenced by changes in life expectancies and interest rates.

Defined benefit schemes account for only about 5% of the Danish pension products.[6]

Defined Contributions

A defined contribution plan specifies how much money must go into a retirement plan today. The amount is typically defined as a percentage of an employee's salary. The level to which pension wealth has accrued by the time of retirement depends on the combined premiums paid by the employee and employer and on the returns of the investment plan. At retirement, the wealth can either be allocated to a fixed annuity with guarantees or a variable annuity without guarantees.

In Denmark, the second pillar consists completely of DC schemes. At retirement, one can decide to take out a part of pension savings as a lump sum and use the remaining to finance a lifelong annuity, while in the Netherlands partial lump sums generate a heavy tax levy. DC products in Denmark have traditionally included an interest guarantee. These guarantees have gradually been decreased due to the low interest rates. This development serves as a motivation for investigating the transition from guarantees to non-guarantees.

6 A DB pension scheme for civil servants in government differs from the occupational pension schemes in the second pillar in three central ways. First, it is enforced by legislation and thus statutory. Second, it is tax-financed through a PAYGO system. Finally, it is not negotiated through a collective agreement the way the occupational pensions are. Therefore, these DB products are categorised as belonging to the first pillar instead of the second pillar. This means that there are no DB schemes in the second pillar in Denmark.

At retirement age, the accumulated pension wealth must be converted into an annuity. As such, there is conversion risk, meaning that, if interest rates are low at conversion, an annuity is relatively expensive. Thus, for a given pension wealth, the annual pension payments will be lower than when interest rates are high at conversion. This is independent of whether one buys a fixed or a variable annuity.[7] In the Netherlands, the AFM protects pension holders against conversion risk by imposing interest rate hedges.[8] For bonds with long maturities, these will be high in value when interest rates are low and thus compensate the loss on the annuity, and vice versa.

In Denmark, no significant distinction is made between pension funds and insurance companies. In the Netherlands, on the other hand, there is a distinction. In particular, since this paper discusses transitions within DC products, we focus on insurance companies as these are the main DC plan providers. The difference is that, when a pension fund cannot fulfil its obligations, the employer and employees bear the loss under a recovery plan. In an insurance company, the equity holders would have to pay extra since there no recovery plans are involved. However, equity holders have limited liability. Insurance companies are therefore required to hold large capital buffers rather than measure the funding ratio which determines indexation or decreasing pension payments in case of too low funding ratios. For lateral pension funds in Denmark, the pension holder is also the equity holder and thus shares the insurance characteristics more closely. For company pension funds, the company is legally liable, but these funds hardly exist in the Danish system. For more details and statistics on the macroeconomic dimensions of Dutch and Danish pension systems, see the appendix.

7 If one assumes that a low risk free rate implies a higher expected return, then the option to invest in equity can reduce conversion risk partially compared to a fixed annuity.

8 AFM is the Netherlands Authority for the Financial Markets, similar to the Danish FSA.

3. Variable annuities in the Netherlands

Since the recent financial crisis, the funding ratios of various Dutch pension funds dropped below 100% due to the low interest rates and the increasing life expectancies. The combined effect of these phenomena is that pension payments cannot keep up with inflation. Moreover, regulation forces pension funds in a DB scheme, that are expected to remain underfunded for several years, to present a recovery plan. Such a plan can entail a cut in pension payments. These developments among many others have triggered a debate about the need for a revision of the pension system in the Netherlands. An important part of this debate centers on the move from guaranteed to non-guaranteed pensions.

The Social and Economic Council has analyzed several reforms.[9] Variant IV-C, called "personal pension wealth with collective risk sharing", gets much attention. In this variant the pension holder saves for his own pension within a collective pension fund, supplemented by a special buffer fund in which the different generations compensate each other for intergenerational effects. In Variant IV-A, shocks are absorbed individually but micro longevity risk is shared. In Variant IV-B, investment risk can be shared as well but not across generations as in IV-C.

On a smaller scale, a new law for DC schemes, which has been in place since September 1, 2016, gives the possibility of turning accrued premiums into a variable instead of a fixed annuity. The Premium Schemes (Improvement) Act ("*Wet Verbeterde Premieregeling*" in Dutch, or WVP), serves as a pioneer in the movement towards a more flexible pension system. This Act is equivalent to Variant IV-A for the DB reform.[10] Balter and Werker (2017) have analyzed the technical impact of the assumed interest rate and of smoothing financial shocks on expected pension payments.

3.1 Variable annuities

The WVP enables pensioners who have accrued pension rights in the second and third pillar to invest their pension wealth in a variable annuity. This gives them the option to keep investing in risky assets after retirement. Before the introduction of the WVP, it was compulsory to convert the pension wealth into a fixed annuity if the pensioner wanted to benefit from tax deductibility. The new option leads to uncertain pension payments. This explains the term *variable* annuity. Another choice that pension

9 The *Sociaal-Economische Raad* (SER) advises the Dutch government and parliament on key points of social and economic policy. See *https://www.ser.nl/~/media/db_adviezen/2010_2019/2016/persoonlijk-pensioenvermogen.ashx*

10 Also a collective risk-sharing mechanism is possible in WVP, which is more like IV-B.

providers now have is that they can choose the assumed interest rate (AIR).[11] The AIR determines the allocation of total pension wealth over future pension payments. Thus it divides the "pot" of money over the remaining lifetime of the retiree. This implies that pension providers can, for instance, offer an initially low expected pension in return for higher payments at a later age.

If financial shocks are absorbed immediately, pension payments will become volatile. This is undesirable since individuals prefer to smooth changes so as to keep a stable standard of living. Therefore, institutions can smooth shocks over several years. To ensure that the variable payments do not decrease too much, it is also possible to adjust the AIR such that it generates constant expected pension payments. The AIR becomes horizon-dependent in this case. Especially in collective systems, smoothing financial shocks can cause redistributions between generations. We do not discuss here, however, the issues of fairness that this raises; see Bonekamp et al., 2016a, for a discussion on this.

Other factors are regulated by the Dutch Central Bank, such as how pension funds and insurance companies deal with sharing longevity risk and smoothing financial shocks. The Authority for the Financial Markets focuses on communication. Pension product providers are obligated to share the micro longevity risk of the individual pension holder. Macro longevity risk can be transferred from the provider to the pension holder when the fixed annuity is changed into a variable annuity. Prior to the change in law, a fixed annuity was the only product that a retiree with a DC capital could purchase. Since the fixed annuity does not contain risk, the pension payments are known from the moment of retirement onwards, so that the macro longevity risk lies with the provider.

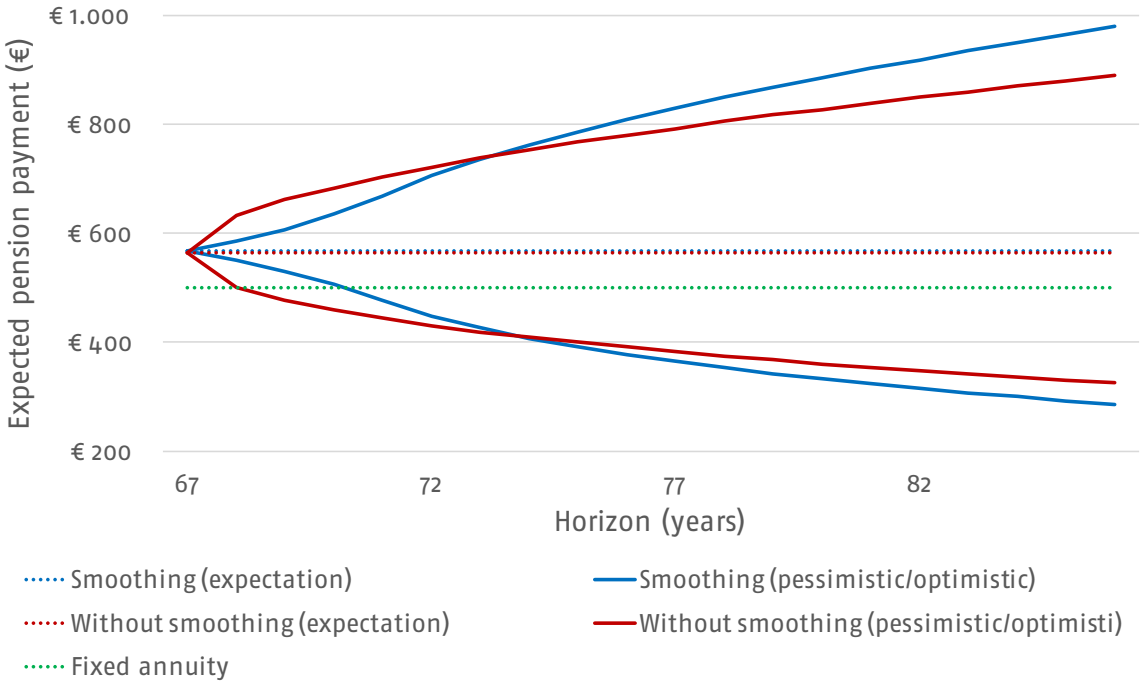
3.1.1 Illustrating pension accumulation in the Netherlands

Figure 1 depicts the expected pension payments for an individual who currently attains the pension age of 67. The calculations underlying the figure are based on the Black-Scholes/Merton model and are described in Balter and Werker (2017).

The green dotted line in Figure 1 shows a pension holder's monthly pension payment if he (or she) chooses a fixed annuity. His accumulated pension wealth has attained a certain value, with which he must buy a lifelong annuity. Since he buys a fixed annuity, he attains the risk-free rate so that future payments are known ahead. Note that, for simplicity, a fixed horizon is used. Macro longevity risk is borne

11 In theory, pensioners can choose the AIR and the investment mix, although in practice the number of choices depends on the products available and thus on what the providers offer. In Section 3.2 we describe the options that pensioners can choose from.

Figure 1: Expected pension payments



Source: Balter and Werker (2017)

by the provider, however, and thus the payments are fixed and will not change. Until September 2016, this was the only product available for pensioners within a DC scheme in the Netherlands.

Since that time it is permitted to include risky investments in the decumulation phase, so that individuals can choose between fixed and variable annuities. By investing part of the accrued pension wealth in risky assets, returns become uncertain, and so do the pension payments as a consequence. Note that macro longevity risk can now cause fluctuations in pensions since providers are allowed to pass on investment risk and/or macro longevity risk. Based on a risk-return trade-off argument, the potential gain of the risky investment is the risk premium. Therefore, the expected pension payments are higher than the fixed payments since the latter do not include a premium on top of the risk-free rate. This is shown by the red dotted line. The red solid lines show the 95% confidence interval of the extra risk entailed by the risky investments.

It is also possible to smooth financial shocks as described earlier. All other factors remaining equal, this option will lead to lower risk in the near future at the cost of

extra uncertainty later. This is depicted in Figure 1 by the blue lines.[12] Less overall risk could compensate this at the cost of lower expected returns. Smoothing raises new issues in particular in the collective WVP or IV-B. For example, avoiding actuarial unfair participation in IV-B is technically non-trivial, see Bonekamp et al. (2016b). All expected payments are constant in Figure 1. The AIR, which is the parameter that distributes the proportion of total wealth, determines the shape of the expectation. The WVP Act specifies the following rule: the maximum allowance on the assumed interest rate equals the proportion of wealth that is invested in risky assets multiplied by the risk premium, with a maximum of 35% of the risk premium. This rule ensures non-decreasing expected nominal pension payments.

In the next subsection, we discuss the products that have recently entered the market in response to the new legislation.

3.2 Regulation and products

The many options in product choice and design increase the complexity for pension scheme members. Variable annuities increase the nominal risk but potentially increase the expected return as well. Both pension providers and members have several choices, which are summarized below:

Choice of the pension provider	Choice of the participant
Flat or increasing expected payment stream	Pension provider
Smoothing of shocks	Fixed or variable annuity
Macro longevity	Risk profile
Number of risk profiles	Survivor pension
Hybrid option	
Change date	
Survivor pension	

Pension providers can choose the number of options to offer to members. The AIR together with investment mix determines the product. The higher the AIR, the larger the fraction of total pension payments that are paid out in the early phase of retirement (at the cost of relatively lower payouts later in retirement), the higher the level of risk, and the higher the potential return, and consequently the higher the expected pension payments.

12 Figure 5 is based on the assumption that 35% of wealth is invested in risky assets. When smoothing, the percentage invested in risky assets is 46.5% to obtain the same expected pension with a smoothing period of five years as without smoothing. The expected risk premium is 4%, and the volatility of the risky assets is 20%.

Overall, regulation states that the investment mix should match the risk appetite of the member. Dutch law also states that micro longevity risk is shared among pools of pension scheme members and thus borne by the provider. Variable annuities potentially move macro longevity risk from the provider to the member, leading to higher uncertainty about pension levels. The provider can choose whether the provider or the member bears the macro risk.

Hybrid structures are combinations of fixed and variable annuities. They provide a floor that reflects a minimum pension, contrary to the theoretical possibility of receiving no pension at all due to continuous rebalancing. Some providers facilitate these combinations, or they allow investing part of the pension wealth in the variable annuity products and the remainder in the fixed annuity.

Pension scheme members are asked both before and at the time of retirement which product they want to buy. A choice made at retirement is definitive. Before retirement, the option to change from a fixed to a variable annuity must take place at the time point when the lifecycle investment strategy aimed at a fixed annuity differs from the strategy that moves towards a variable annuity. The risk exposure depends on age, so if a retiree chooses a fixed annuity the exposure at retirement is zero, and a gradual decline in exposure deviates from gradual convergence to the exposure that is inherent to the variable contract.

The pension provider may decide to include a partner pension in the variable annuity product. Consequently, the pension holder can choose this or not. If a person who has opted for this dies, the partner will receive variable or fixed payments depending on the agreement, although lowered by a predecided factor.

Participants are thus given the opportunity to choose between fixed payments from their retirement age onwards or to make use of the risk-return trade-off. Since the choice is presented before retirement, pension holders have several phases during which they can decide. However, the investment mix in the accumulation phase will be adapted to the desired investment mix in the decumulation phase. Therefore, a smooth transition is more likely when the decision is consistent.

Members moreover have a shopping right, meaning that if their current pension fund does not give both options, they may switch to another provider. Plus, one can always change insurance company.

3.2.1 Examples of products with variable annuities in the Netherlands

Since September 1, 2016 several providers offer products with variable annuities. We summarize the main characteristics of these products in Table 2.

Table 2: Variable annuity products in the Netherlands
The main characteristics of the different products that provide a variable annuity.

	Investment Mix	Hybrid option	Life cycle	Insure macro longevity	Smoothing shocks
Allianz	31%	Yes	20 years	No	No
Aegon	66%	No	Yes, little	No	No
Delta Lloyd	15%, 30%, 45%	Yes	27 years	Yes	5 years
Nationale Nederlanden	35%	No	Yes, till age 85	Yes	No

The new product "Allianz Pensioen Doorbeleggen" is based on investing 31% of pension wealth in equities, with a gradual decrease to 0% over 20 years. Hence, if we assume a retirement age of 67, then no risk is taken anymore from the age of 87. Allianz also offers investment mix products consisting of a combination of a fixed and a variable annuity. These hybrid products provide a minimum guarantee, whereas strictly variable annuities can theoretically not pay out at all because of continuous rebalancing. They offer a guarantee in which 0%, 25%, 50%, 75%, or 100% is invested in the fixed annuity and the rest in the variable annuity. Allianz does not inform the pension holder explicitly about the assumed interest rate, although there is the option to choose between "payments that are comparable with a guaranteed payment in the beginning and that can later increase based on the realized return" or "payments that are higher than a guaranteed payment in the beginning, while afterwards the realized return should ensure that the payments remain at the same level".

Aegon invests 66% in risky assets and decreases this gradually, as described in the document accompanying its product "Aegon Uitkerend Beleggingspensioen". It currently provides no option for a hybrid structure unless double fixed costs are paid. The rate applied to distribute the total wealth is set at 2.1%.

Nationale Nederlanden reduces the investment mix in the decumulation phase indirectly, by allocating each year 1/18th of pension wealth to a fixed annuity, leading to zero variability from the age of 85. Participants are insured against macro longevity risk in the product called "Variabel Pensioen". This Nationale Nederlanden product is exposed for 35% to financial risk.

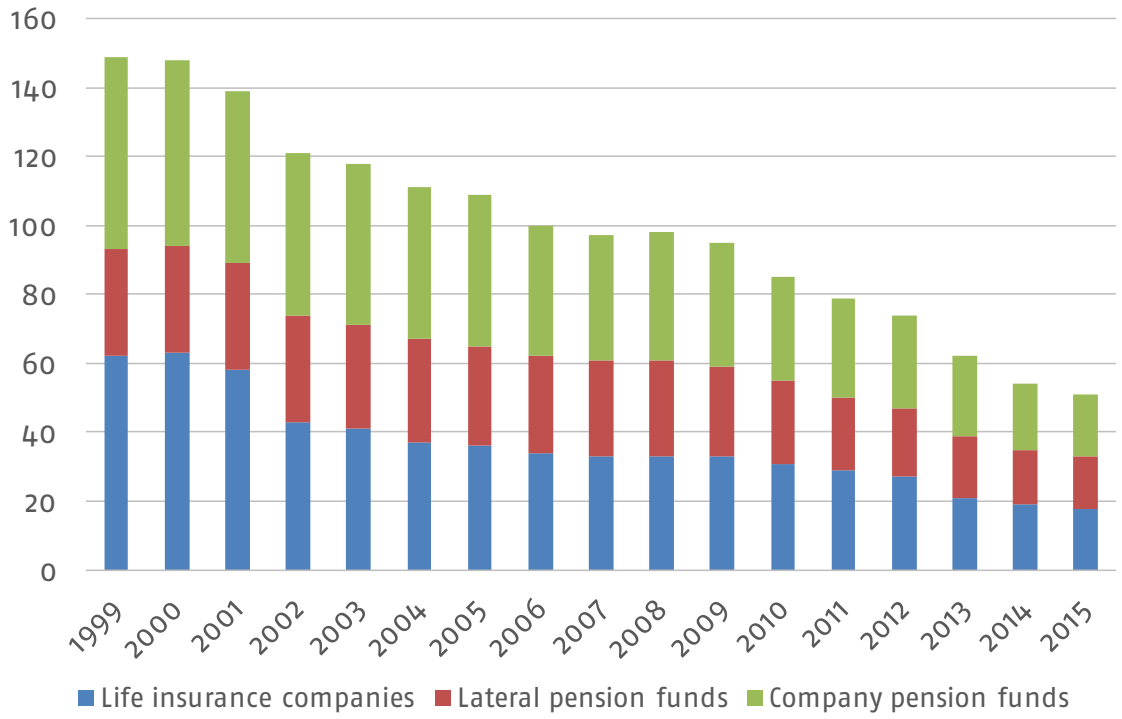
Delta Lloyd offers the same two options as Allianz under the name "Direct Ingaand Variabel Pensioen". The initial high variant depends on the assumed interest rate. Depending on the risk profile, the proportion of the pension wealth invested in risky assets is 15% in the defensive profile, 30% in the neutral profile, and 45% in the offensive profile. After age 85, the investment risk is decreased in nine years to 0%. Moreover, these three options are all hybrid constructions since 85%, 70%, or 55%

respectively of the total value at retirement is initially used to buy a fixed annuity, while the remainder is invested in the variable annuity with 100% in equities. In other words, there is no rebalancing effect in this set-up. Macro-longevity is insured and thus borne by the provider at Delta Lloyd only. All other providers transfer the risk to the members. In addition, Delta Lloyd smooths financial shocks over five years. In their product descriptions, providers show the first pension payment and the expected pension payment at year ten after retirement in a good scenario and in a bad scenario. Allianz shows a graph in which all payments are visible. Balter and Werker (2017) show that the AIR has only a minor effect on the 10th expected payment, while a high AIR has a large downward effect on later pension payments, as demonstrated in Figure 1. The uniform set under which the different scenarios should be derived is still being developed by the Parameters Committee, which uses the stochastic scenario structure described in Koijen et al. (2010). Until then, a simplified temporary regulation about information provision related to the WVP applies.

A puzzling observation is that the products yield decreasing expected pension payments over time. The AIR is capped at the lower of 35% and the investment mix of the risk premium. Hence, if one invests more than 35% in risky assets, the AIR will be less than the expected return, which leads to increasing expected pension payments. On the other hand, if one invests less than 35% in risky assets, then the AIR does not exceed the expected return. This technical rule has been discussed by the Dutch parliament and implemented to protect individuals against decreasing pensions. However, the expected pension payments offered by the providers described above show decreasing pensions. This is under current investigation by the AFM.

We also see that the individual pension holder cannot directly choose an AIR. Only in the case of Allianz and Delta Lloyd can individuals opt for two different payment streams, which link indirectly to the concept of the AIR. The investment mix cannot be chosen by the individual pension holder either, even in the case of Delta Lloyd, which investigates the risk profile and allocates a certain investment mix to the profile. Besides these insurance providers, there are also pension funds that offer variable annuities, e.g. Shell, Capgemini, and KPN. The Dutch financial press published some initial figures on the frequency of choice for variable annuities (Het Financieele Dagblad, 2017). Between 5% and 10% of the pension holders of Nationale-Nederlanden chooses variability, and this is expected to rise further. Before the summer of 2017, 10% of the DC holders of Aegon switched to the variable annuity; this increased to 25% after the summer of 2017.

Figure 2. Number of Danish pension funds



Source: Insurance and Pension (2017a)

4. Pension guarantees and non-guarantees in Denmark

4.1 Annuity pension in Denmark

Work-related pension schemes in Denmark are composed of different elements in terms of type of product, premiums, fees, asset allocation, pension benefits, and insurance cover, so the composition varies across pension funds. Besides life insurance companies there are two types of pension funds with very similar legislation: company pension funds and occupational pension funds. The development of the number of Danish pension funds is shown in Figure 2.[13]

Lateral pension funds are organized on the basis of sectors and type of work. They are non-profit organizations owned by both the employer organizations and the labor unions. This means that every decision, including decisions on investment, is the outcome of a collaborative process. The funds manage contributions, investments, and payouts. The activities of the funds are regulated by law. Pension assets may be used to cover actual pensions or insurance products linked to the pension scheme (disability pensions, spouse/children pensions).

13 Twenty of these are private funds, cf. Section 2.

The pension products can be divided into three general categories with different payout patterns, see Danish FSA (2017):

1. Annuities (57%): lifelong pension payments.
2. Fixed period annuities (28%): payments ranging between 10 up to 25–30 years depending on the contract. Pension payments revert to the surviving relatives when the insured person dies.
3. Age pension (15%): paid as a lump sum or in multiple installments.

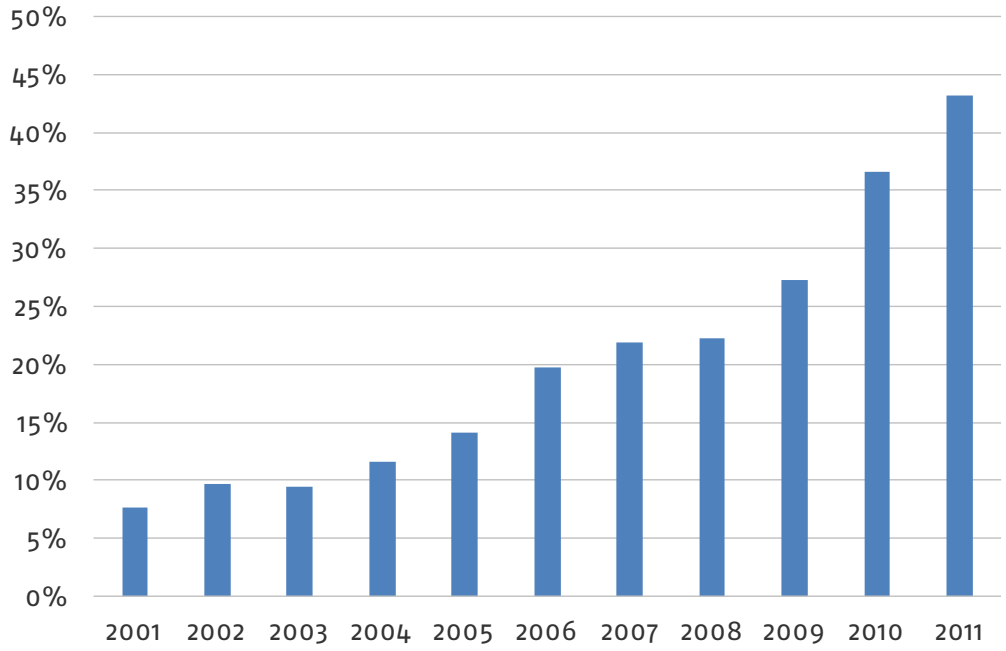
Most lifelong annuities contain a variable element, which is explained in greater detail in Section 4.2. The last two schemes can be categorized as savings-based, whereas the annuity scheme is insurance-based, where until recently the longevity risk for the majority of contracts was shared between the members. In all three schemes, contributions plus the market return on investments determine the pension benefits that the pension holder is entitled to at retirement. Thus any interruptions of the work career due to maternity leave, sickness, and unemployment, as well as wage fluctuations, are reflected in the pension payments. Finally, contributions are tax deductible while payouts are taxed, similar to the Dutch system

The focus of this paper is on lifelong annuity schemes, but within this category different pension savings products exist. Overall, a distinction is made between traditional participating contracts, so-called with-profits, and unit-linked contracts. There are also a number of contracts which can be regarded as a mix or extended version of the two, with "time pension", a smoothed investment-linked annuity scheme, being the most popular. "Time pension" combines the principle of individuality and transparency regarding market returns from unit-linked products with the smoothing of returns from the traditional with-profit products, see Jørgensen and Linnemann (2012) and Jakobsen (2003).

The majority of arrangements are set up as with-profit deferred annuity contracts. However, unit-linked products have become a growing part of the total market. Figure 3 shows unit-linked insurance premiums in relation to total gross premiums in Denmark.

The majority of products have historically included a guaranteed annual return based on a minimum guaranteed interest rate. In pension schemes established before January 1996, the interest rate was usually between 3.7% and 4.5%; for schemes established between 1997 and July 2005, the interest rate varied between 2% and 3%. Since then, the guaranteed interest level has varied between 1.25% and 0.00%. The guaranteed average interest products ensure that the pension holder receives a minimum annual return throughout the life of the contract, thus both in the accumulation

Figure 3. Unit-linked insurance premiums as a percentage of total gross premiums in Denmark



Source: Insurance and Pension (2017b)

and the payout phase. This nominal guarantee was issued at the start of the contract. For instance, within the unit-link framework the guarantee can be regarded as a simple European put option. If the fund value at maturity (retirement) is less than the guaranteed payoff, then the put option is "in the money", as seen from the point of view of the pension holder. Thus, if disappointing returns in the accumulation phase imply that the retirement account delivers less than the guaranteed level at retirement, then the pension fund is required to pay out the guaranteed amount. The potential unsustainability of these products in the long run helped trigger the Danish transition to non-guarantees. There has been a debate as to whether the annual guarantee should be understood as a minimum return every single year or as an average annual return during the accumulation phase. A court ruling by the Danish Supreme Court k in 2016 has made clear that these are guaranteed average annual minimum returns. In recent years, contracts have been issued with conditional guarantees, meaning that the pension fund will only be unable to honor the guarantee if certain events occur, e.g. if unexpected increases in life expectancy are observed.

For unit-linked contracts, the amount of pension savings is directly linked to the market value of the units that the individual pension holder's portfolio is invested in. Pension holders can freely choose between units and can thus influence the risk

level of the investment profile. However, the interest rate guarantees imply incentives to increase the risk level of investments. Pension funds have imposed restrictions on investment rules for unit-linked contracts with guarantees in terms of the mix of financial assets and type of investment funds.

The traditional participating with-profits contract is slightly more complicated and opaque as the typical profit-sharing contract can be decomposed into a risk-free bond element, a bonus option, and a surrender option, see Grosen and Jørgensen (2000, 2002). The majority of the contracts are issued without an option for the pension holder to sell back the policy at face value before maturity: this is the surrender option. The pension holder participates in an investment community together with the other pension holders and the owners of the pension fund. This joint portfolio ownership makes it challenging to identify which assets belong to the individual pension holder and thus the amount by which the individual pension account should be increased each year. The distribution of surplus between pension holders is required to be fair in the sense that the surplus should be redistributed to those who earned it. The individual pension fund determines the annual rate of interest on pension holder's savings by applying a wide array of factors, such as actual investment returns, the size of the company's free buffers and bonus reserves, the level of guarantees provided, the outlook, and the competition, see Jørgensen and Linnemann (2011). Part of the surplus is deposited into an "undistributed" reserve to smooth fluctuations in investment return over various calendar years. The pension fund is not allowed to grow "large" undistributed reserves as it could theoretically redistribute surplus from the past and present pension holders to future pension holders. The undistributed reserve is allocated to a buffer belonging to a group of pension holders with the same investment profile, and the size is determined according to the risk profile of the investments within that group. In these types of contracts the pension funds incur both investment risk and longevity risk. The distributed part is allocated to the pension holder as a percentage of the surplus according to the relative weight of the contributions. Thus the Dutch "DB" plan indexation works similar to the Danish with profit plans.

During the past ten years, most players in the pension industry have moved the annuity contracts specified as guaranteed average interest products to unguaranteed market return products. In the case of market return products without guarantees, the pension funds transfer the annual returns from the pension holder's pension assets to the pension holder's pension depot. Thus, in years of poor financial market performance, pension payments will potentially be reduced accordingly. Moreover, increases in life expectancy will also imply benefit reductions in the payout phase. Thus, the

pension holder incurs both financial risk and longevity risk. However, the larger degree of freedom regarding investment strategy, combined with lower solvency capital requirements (as pension funds no longer have to honor interest rate guarantees) enables more risky investments and thus higher expected returns. On the investment side, market interest return products follow a lifecycle strategy.

Depending on the type of contract, the fund value (or guaranteed value) is converted into either a fixed annuity or a variable annuity (after 2011). In theory, the fixed annuity can be variable if the pension holder has with-profit contracts as the annuity payments can be increased by bonus payments if actual investment performance exceeds the guaranteed return. A number of pension funds allow for flexibility in the payout phase. It is possible to receive higher pension benefits in the early years of retirement at the cost of lower pension benefits in later years, and vice versa. The rules regarding the regulation of the size of benefits vary significantly between funds. Finally, some providers combine market return products with a smoothing mechanism in the payout phase, meaning that they withhold part of the pension holder's pension assets at retirement. This buffer is used to smooth pension payments across time. However, if the market performs poorly for a longer period, it will be necessary to reduce pension payments accordingly.

Conversion risk, as described in Section 2.2.1., also exists in Denmark. Since the pension providers decide on the exact investment strategies, they are responsible for addressing conversion risk. It is not clear that pension holders are made sufficiently aware of this mechanism.

4.2 From guaranteed to unguaranteed annuities

In May 2010, the sixth largest Danish pension fund, Sampension, decided, in cooperation with central labor market players behind the collective pension schemes, to discontinue the guaranteed benefits as from January 1, 2011. The fund argued that it was struggling to meet the new Solvency II rules, which would result in significantly stricter capital requirements applying to pension products with guaranteed benefits. Sampension manages pension schemes for Danish municipalities, the union of commercial and clerical employees (HK), Local Government Denmark, and other small groups. In total, it covers more than 300,000 pension holders. At the time, Sampension offered three products: average rate (policies with profit sharing), 3 i 1 Livspension (a lifecycle product), and Linkpension (unit-linked), with the majority of the products being profit-sharing.

The move of pension holders in Sampension from a guaranteed to an unguaranteed product inspired the majority of the Danish pension funds to introduce a similar

change for their pension holders. In some cases, the pension funds made a collective decision to transfer all pension holders to zero-interest guarantees, while other funds (Danica, PFA, JØP, and others) offered pension holders the option to decide for themselves whether they wanted to give up their interest guarantees. Moreover, it implied that the pension holders would now carry both financial and longevity risk as the pension benefits were made variable in the payout phase, based on market performance and life expectancy developments. Prior to these events in 2010 and 2011, there had been some cases where pension funds had invited their pension holders to relinquish their interest rate guarantees. In 2007, JØP made such an offer.

4.2.1 Illustrating pension accumulation in Denmark

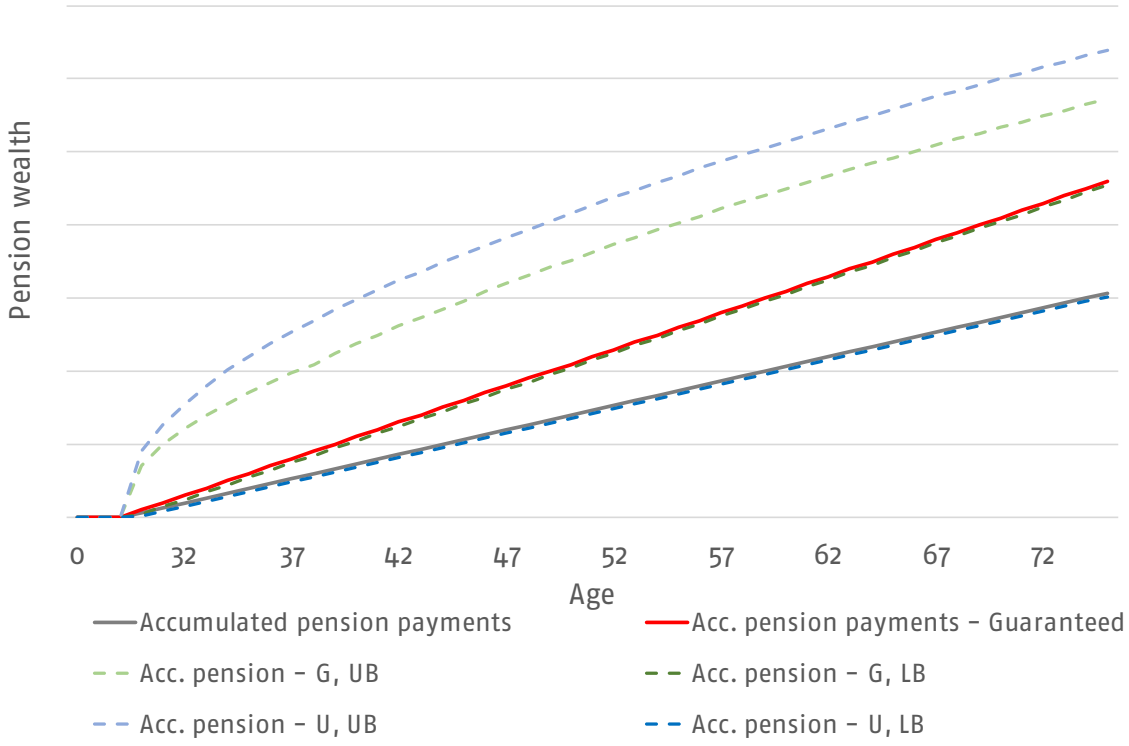
For illustration purposes, Figures 4 and 9 show how the guaranteed products (interest guarantee greater than zero) and unguaranteed products (interest guarantee equal to zero) for lifelong annuities in with-profit contracts differ in both the accumulation and the decumulation phase. The figures are constructed assuming two identical individuals who only differ in terms of whether their pension product is guaranteed or unguaranteed.

In Figure 4, we show how the pension wealth of the two individuals evolve during the accumulation phase.

The black line shows how both types of individuals' pension wealth grow throughout their work life as they continue to pay contributions. The "guaranteed" individual accumulates higher expected pension wealth as shown by the red line. This is due to fact that a guaranteed average annual minimum return is added to that person's account on top of the pension contributions. The uncertainty related to the "guaranteed" person's account is depicted by the green dashed lines. If the pension fund performs well in the financial market, it has the option of distributing a bonus on top of the guarantee. The interest guarantee ensures that the policyholder's accumulated pension wealth is bounded from below, as indicated by the dark green dashed line (overlapping with the red line: accumulated pension wealth plus the added guaranteed return). Thus the "guaranteed" individual only takes part in the upside, indicating that the value of the policy can only increase.

The "unguaranteed" individual, with a zero percent interest guarantee, is only guaranteed the value of his or her accumulated pension wealth. However, as the pension fund is able to invest in more risky products for this type of policyholder, a higher return is expected, as illustrated by the light-blue dashed line, higher even than the combined value of the interest guarantee and bonus distributions (based on realizations of the last five years). Due to the zero percent guarantee, a minimum

Figure 4. Pension wealth during the accumulation phase.

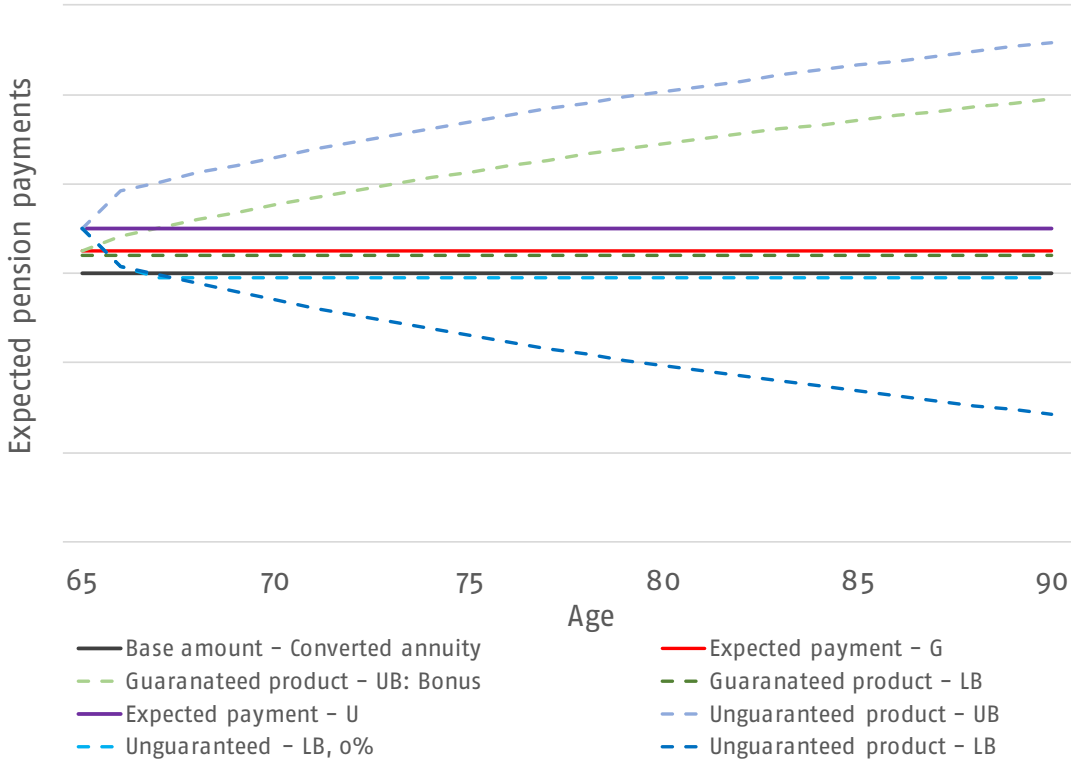


wealth equal to the nominal contributions forms the lower bound, as illustrated by the dark-blue dashed line.

In Figure 5, we show the expected pension payouts for the two types of individuals, who at retirement have accumulated an identical amount of pension wealth. At retirement, total accumulated wealth is converted into an annuity, as indicated by the black line. The "guaranteed" individual can *with certainty* expect a higher pension payment than as reflected by the black line since the interest guarantee holds throughout the life of the annuity, thereby increasing the base amount from the black to the red line. Similar to the accumulation phase, the uncertainty regarding the size of the pension payouts in the decumulation phase only arises from potential bonus distributions (light-green dashed line) and is bounded from below by the positive interest guarantee (the dark-green dashed line).

The "unguaranteed" individual can on average expect higher returns due to more risky investments, as depicted by the purple line. The uncertainty regarding the expected payouts is greater, thus the upside from unguaranteed marked interest pension products is potentially higher (light-blue dashed line). The expected pension payments are bounded from below by the zero percent guarantee (blue dashed line), equivalent to the black line for the base amount of the converted annuity. However,

Figure 5. Expected pension wealth during the decumulation phase.



as the zero percent guarantee is a conditional guarantee, pension payouts can be reduced if the pension fund consistently performs poorly in the financial markets or if macro longevity increases more than initially anticipated (dark-blue dashed line). This makes the annuity variable in both upward and downward directions.

The Danish FSA has been heavily involved in the supervision of the discontinuation of interest guarantees. Many questions have been raised: did the pension holder receive sufficient information about the financial implications; how do you determine the value of the interest rate guarantee; to what extent should the pension holder's individual account be increased when this guarantee is eliminated; how much of the undistributed bonus reserved for the participating contract with profit sharing was the pension holder entitled to, etc.?

In 2014, the Danish Financial Business Act was amended, and in particular a §60a was added, containing guidelines on how to determine the financial value of pension holders' accounts when giving up the interest rate guarantees. Moreover, it specified how much of the undistributed reserve should be allocated to each individual, how much the pension fund can charge regarding administration costs for transferring the policy holder, requirements regarding documentation to ensure that no redistribution

between policyholders takes place, and the amount that can be withheld by the pension fund as a buffer for unforeseen events. These guidelines might contain relevant inspiration for other countries, including the Netherlands, on how to regulate a shift from guaranteed to non-guaranteed products.

4.3 Evidence from a Danish mid-size pension fund

The Danish pension fund Juristernes og Økonomernes Pensionskasse (JØP) is intended for lawyers and economists. It is fully funded and owned by its more than 60,000 members. The assets managed by JØP amounted to DKK 72.4 billion (app. USD 12 billion) in 2016. Until recently the fund only offered guaranteed average interest products, which ensured a minimum return for its pension holders as they were given an annual nominal guarantee at the start of the contract. The members have been offered different guarantees depending on their date of admission as displayed below.

Date of Admission	Level of Guarantee
Before January 1, 1990	3.70% or 4.25 %
January 1, 1990 – December 31, 1996	3,70%
January 1, 1997 – June 30, 1999	3,00%
July 1, 1999 – July 1, 2005	2,00%
From July 1, 2005	0,00%

Pension holders with a guaranteed interest rate above zero are grouped into a separate division within the pension fund, called Division 1. Over the past ten years, the fund has undergone a gradual transition from guaranteed to unguaranteed products. In the first election in May 2007, the 31,497 pension holders in Division 1 were offered the possibility of voluntarily giving up their interest guarantees, with the prospect of an investment strategy that enabled more risky investments and thus higher expected returns. This election thus involved an individual voluntary choice. Moreover, members were informed that the expected capital requirements in Solvency II would most likely lead to lower future expected returns for individuals with a high guaranteed interest level.

To enable us to analyze individual characteristics that would affect the probability of pension holders giving up the guarantee, we were granted access to a cross-section of pension holders in Division 1 from October 2007. We obtained information about various personal characteristics as well as financial information. Table 3 contains descriptive statistics and reports the mean and the standard errors of the explanatory variables. The dependent variable Election_Outcome is a dummy variable that is

Table 3. Summary statistics: JØP's members who change their pension product

Variable	Obs.	Mean	Std. Dev.
Election_Outcome	31.497	17,9%	38,3%
General			
Male	31.497	56,2%	49,6%
Married	31.497	65,4%	47,6%
Retired	31.497	5,7%	23,2%
Age			
Age_2029	31.497	3,7%	18,9%
Age_3039	31.497	38,4%	48,6%
Age_4049	31.497	27,5%	44,7%
Age_5059	31.497	18,1%	38,5%
Age_6069	31.497	8,3%	27,7%
Age_6669	31.497	2,0%	14,0%
Age_70100	31.497	2,0%	14,0%
Education			
Economics	31.497	15,7%	36,4%
Political Science	31.497	19,3%	39,5%
Law	31.497	33,8%	47,3%
Business Economics	31.497	12,9%	33,5%
Education_Other	31.497	18,3%	38,6%
Region			
Copenhagen	31.497	50,6%	50,0%
Greater Copenhagen	31.497	9,0%	28,6%
Zealand & Falster	31.497	8,5%	27,9%
Funen & Islands	31.497	4,0%	19,6%
South Jutland	31.497	3,5%	18,3%
West Jutland	31.497	3,0%	17,0%
Central Jutland	31.497	11,2%	31,6%
North Jutland	31.497	4,4%	20,6%
Region_Other	31.497	5,8%	23,5%
Level of Guarantee			
InterestGua_2	31.497	31,9%	46,6%
InterestGua_3	31.497	11,8%	32,3%
InterestGua_3_7	31.497	25,8%	43,8%
InterestGua_4_25	31.497	30,5%	46,0%
Level of Pension Wealth			
PensionWealth_VeryLow	31.497	16,4%	37,0%
PensionWealth_Low	31.497	32,1%	46,7%
PensionWealth_Medium	31.497	22,1%	41,5%
PensionWealth_High	31.497	21,2%	40,9%
PensionWealth_VeryHigh	31.497	8,1%	27,3%

assigned a value of 1 if a pension holder in Division 1 voluntarily chose to opt out of the current interest rate guaranteed contract.

We see from Table 3 that 18% made this choice. The Male dummy variable for gender shows that more than half (56%) of the policy holders are male, which corresponds well with the higher workforce participation rate for men. The majority of pension holders are married (65%) according to the dummy variable Married, whereas only 6% of the pension holders are currently in retirement. Age is divided into seven age categories: age_2029, age_3039, age_4049, age_5059, age_6065, age_6669, and age_70100. The variable age_2029 takes the value 1 if the individual is between 20 and 29 years old in 2007, and so forth. We clearly see that the pension fund is relatively young as almost 70% of the pension holders are under the age of 50.

The level of education corresponds for almost all members to a university degree at bachelor's level or higher. It is divided into five field categories: Economics, Political Science, Law, Business Economics, and Other. Approximately 29% of the pension holders hold a degree in Economics or Business Economics, 20% in Political Science, and 33% in Law. As to geographical location, we distinguish nine different regions in Denmark. These are Copenhagen, Greater Copenhagen, Zealand & Falster, Funen & Islands, South Jutland, West Jutland, Central Jutland, North Jutland, and Other Regions. Almost 60% of the members live in Copenhagen and Greater Copenhagen, 11% in Central Jutland (including the second largest city, Aarhus), and the remaining 30% are distributed around the country. In terms of interest rate guarantee, 30% of the members in Division 1 have the highest level of 4.25%, 26% have a 3.7% guarantee, 12% a 3% guarantee, and 32% a 2% guarantee. Thus, a significant part of the Division 1 members still had a high level of guarantees, even in 2007. Finally, we have information about the size of Pension Assets and the level of contributions. (Contributions are not displayed in the table nor included in the analysis as contributions and wealth are highly correlated.) Pension Wealth is divided into five categories based on the individual's level of pension wealth.

Level of Pension Wealth	Values DKK
PensionWealth_VeryLow	Less than 100,000
PensionWealth_Low	Between 100,000 and 400,000
PensionWealth_Medium	Between 400,001 and 800,000
PensionWealth_High	Between 800,001 and 2,000,000
PensionWealth_VeryHigh	Greater than 2,000,000

From Table 3, we see that almost 50% of the policy holders have pension wealth below DKK 400,000, whereas only 8% have pension wealth above DKK 2,000,000.

Table 4. Results from Probit estimation

Number of obs	31.497			
Pseudo R2	16,96%			
	dy/dx	Std.Err.	z	P>|z|
General				
Male	2,72%	0,41%	6,58	0,0%
Married	-0,87%	0,43%	-2,04	4,2%
Retired	-11,35%	4,14%	-2,74	0,0%
Age				
Age_3039	-6,05%	0,91%	-6,62	0,0%
Age_4049	-15,31%	1,02%	-14,99	0,0%
Age_5059	-30,64%	1,33%	-23,01	0,0%
Age_6069	-39,21%	2,26%	-17,38	0,0%
Age_6669	-33,26%	4,07%	-8,17	0,0%
Age_70100	-38,50%	7,82%	-4,92	0,0%
Education				
Political Science	-1,40%	0,64%	-2,19	2,9%
Law	-4,85%	0,63%	-7,74	0,0%
Business Economics	-5,79%	0,72%	-8,07	0,0%
Education_Other	-4,75%	0,71%	-6,7	0,0%
Region				
Greater Copenhagen	-1,73%	0,76%	-2,29	2,2%
Zealand & Falster	-3,34%	0,78%	-4,26	0,0%
Funen & Islands	-1,29%	1,06%	-1,22	22,3%
South Jutland	-3,29%	1,19%	-2,76	0,6%
West Jutland	-4,41%	1,25%	-3,53	0,0%
Central Jutland	0,17%	0,65%	0,26	79,1%
North Jutland	-3,80%	1,01%	-3,75	0,0%
Region_Other	-6,33%	0,92%	-6,85	0,0%
Level of Guarantee				
InterestGua_3	-5,49%	0,64%	-8,61	0,0%
InterestGua_3_7	-8,13%	0,68%	-11,91	0,0%
InterestGua_4_25	-12,40%	1,15%	-10,82	0,0%
Level of Pension Wealth				
PensionWealth_Low	6,27%	0,58%	10,85	0,0%
PensionWealth_Medium	8,35%	0,76%	11,05	0,0%
PensionWealth_High	6,28%	1,05%	5,99	0,0%
PensionWealth_VeryHigh	6,28%	2,19%	0,32	75,2%

Table 4 presents the results from the Probit estimation that explored the relationship between the election outcome and the set of independent variables listed above. The marginal effects and corresponding standard errors are displayed in Table 4. All except three variables (PensionWealth_VeryHigh, Central Jutland, and Funen & Islands) are individually significant at a 5% level. Furthermore, we see from the likelihood-ratio test that they are also jointly significant. We see that men are slightly more likely to give up the interest rate guarantee (2.7%). Marital status has virtually no effect on the decision, whereas being retired decreases the probability of relinquishing the guarantee by 11.3%. Compared to being young (between the ages of 20 and 29), the older a person is, the more likely such person is to remain in the current contract. Being above the age of 50 decreases the probability between 30-39%. We observe regional differences as pension holders in Copenhagen (reference group) are more likely to abolish their guarantee. We find strong significant effects that the higher the level of guarantee, the less likely a person is to give it up. Compared to a 2% guarantee, an individual with a 4.25% guarantee is 12.4% less likely to relinquish it. Finally, higher pension wealth will decrease the probability of giving up the guarantee by 6-8%. All in all, these results indicate that men living in Copenhagen, with low guarantee level and pension wealth, were more likely to give up their guarantee.

5. Lessons learned

Two main differences between the Danish and Dutch situations are that most Dutch private pension products in pillar two are DB whereas the Danish equivalent products are DC, plus the fact that Denmark started the transition towards more risky pension products some years ago whereas in the Netherlands s this transition has started only recently. This gives rise to some lessons from the Danish case that could be relevant for the Dutch case. First, the shifts in Denmark started before regulation was really in place. This means that a number of quite relevant questions were raised during the process where shifts took place. These include questions such as whether the information that pension holders received about the choices they should make was adequate, how to distribute undistributed reserves, how to price the interest rate guarantees that were given up when shifting from one product to another, how to take the risk of changes in life expectancy into account, etc. A clear lesson from the Danish case is that it would be wise to think more about how to regulate these transitions before they actually take place. It is only since 2014, after many customers had already shifted, that clear regulatory guidelines are in place in Denmark. Another lesson from the Danish case in this regard comes from a case study of shifts in a mid-size Danish pension fund. We found that men living in large cities, who have low pension savings and low guarantees, were more likely to switch. A third, more general lesson is that a pension system that is dominated by DC products can provide a good working system and deliver an adequate pension. After all, the Danish pension system is ranked number one in the world. Thus the "fear of the unknown" (i.e., fear of DC products) in the Netherlands is not necessarily justified.

Denmark can, on the other hand, learn from the Netherlands how to inform pension holders about the risk they face. A good feature of the way Danish and Dutch pension projections are made is that all such projections are based on common assumptions about expected returns on different asset classes. In other words, pension providers cannot compete on what they individually estimate expected returns to be. A challenge with the way pension projections are presented in Denmark, on the other hand, is that they show only expected pensions, without. pension holders being told about the uncertainties surrounding pensions. In the Netherlands, pension holders are told, during their working life, about their first expected pension after they retire and ten years after, in both a good and a bad scenario (the 5% and 95% quantile), i.e. a low and a high bound on expected pensions. Given the shift from guaranteed to unguaranteed pensions in Denmark, this is obviously important for

pension holders to know. A process in this direction has only recently been initiated in Denmark.

De Nederlandsche Bank, the Dutch central bank, is influential when it comes to pension regulation, including technical details. No such role exists for the Danish central bank. In Denmark, it is solely the FSA (which is equivalent to the Dutch AFM) that investigates the changes that take place in pension design, and it sets rules to protect pension holders and improve communication. A central bank can establish a framework that might be helpful in answering questions regarding design, feasibility, and fairness. Take, for example, the scenarios used to calculate the risk level of pension payouts. In the Netherlands, it is the central bank that provides these scenarios. In Denmark, it is the industry itself that does this. Another difference is that in the Netherlands it is the central bank and the government that guide a reform of the pension system. In Denmark, the market initiates the process. Concerning the overall reform that is still being discussed in the Netherlands, one could interpret the Danish example as a motivation to speed up the decision-making process and the legislation accompanying the new system, this in order to prevent running behind more or less opaque initiatives in the market. Having guidelines, rules, and regulations in place before transforming a system seems preferable to a setting where rules are introduced after the fact.

Reflecting on conversion risk – the risk that interest rates are low when accumulated pension wealth is used to purchase an annuity – would lead to potential improvements for both countries. In Denmark the FSA can set protective hedging rules to mitigate the risk that annuities are expensive at the time of retirement due to low interest rates. In the Netherlands, opaque communication can be reduced by acknowledging that there is hardly any relation between conversion risk and variable annuities.

All in all, pension systems in Denmark and the Netherlands share many characteristics and challenges. There are some significant differences as well, however. Regulators, pension providers, and pension holders can learn by studying the pension systems in the two countries and comparing them. This is what we have attempted to do in this paper.

6. Conclusion

We have compared the Danish and Dutch pension systems and products. The focus of our paper has been on the shift from "safe" to "risky" pension products (for the customer) in both countries. These shifts occur because of the challenges that face pension systems worldwide, including in Denmark and the Netherlands, in particular in terms of low interest rates and increasing life expectancies.
The main difference between the two systems is that the Danish pension market consists of almost exclusively of DC plans, whereas the majority of Dutch pension plans are DB schemes. This leads to our first observation that also a DC system can be effective and provide adequate pensions. Another lesson is the timing issue, which implies that it is wise to establish regulations before transitions take place. From the Danish case study that we have conducted, we found that men living in large cities, who have low pension savings and low guarantees, were more likely to give up the guarantee. Once the guarantees are given up, we recommend that pension holders should be informed not only about the potentially higher expected returns in the unguaranteed products but also about the associated increase in uncertainty. Given that the Dutch and Danish pensions system rank high on a worldwide scale, these findings should also be relevant for other countries than Denmark and the Netherlands.

Appendix

Macro overview

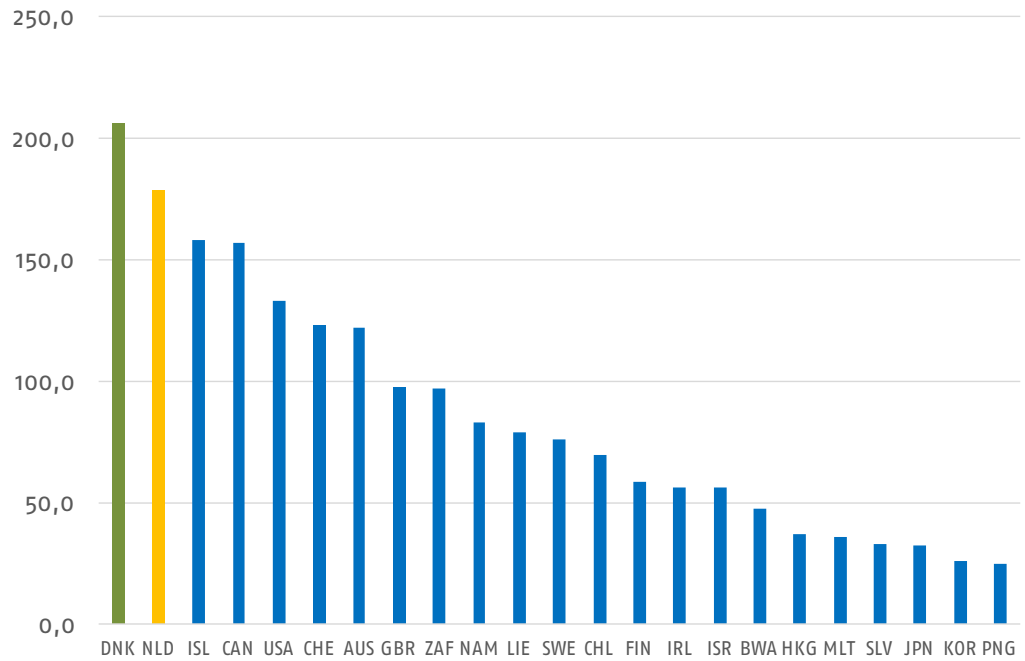
Pension savings in the Netherlands and Denmark are quite substantial. According to the OECD (2015), Denmark is number one in the world in terms of private pension savings, measured in relation to GDP. Private pension savings in the Netherlands are the second highest. In 2015, private pension savings in Denmark amounted to approximately two times Danish GDP, while private pension savings in the Netherlands amounted to approximately 180 percent of Dutch GDP, see Figure 6.

In 2015, total pension savings in the Netherlands amounted to USD 1,317 billion and in Denmark to USD 600 billion. Not surprisingly, the country with the nominally highest pension savings is the US, but the country with the sixth largest amount is the Netherlands, with Denmark right behind as eighth largest (see Figure 7).

The typical size of a pension fund differs considerably between the Netherlands and Denmark. In the Netherlands, there are 319 private pension funds. In Denmark, there are only 20. This means that the average Dutch pension fund manages assets worth USD 4 billion, whereas the average Danish pension fund manages USD 30 billion.

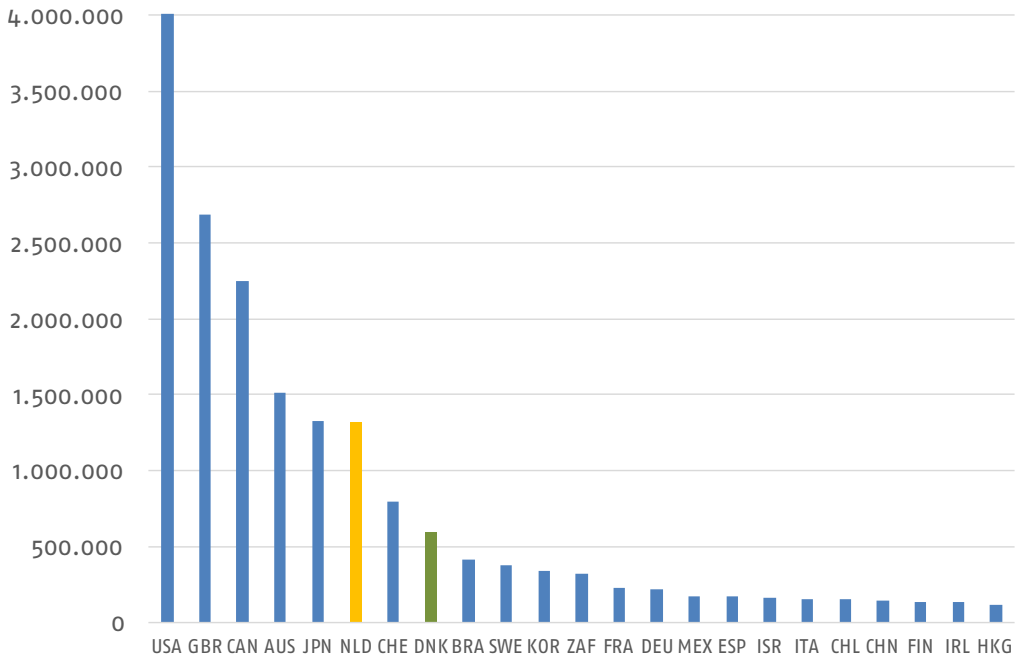
Life expectancy is likely to increase in the Netherlands and Denmark, as in most OECD countries. In 2010, a 65-year old man could expect to live for 17.6 more years in the

Figure 6. Contribution of private pension investments to GDP per country (2015)



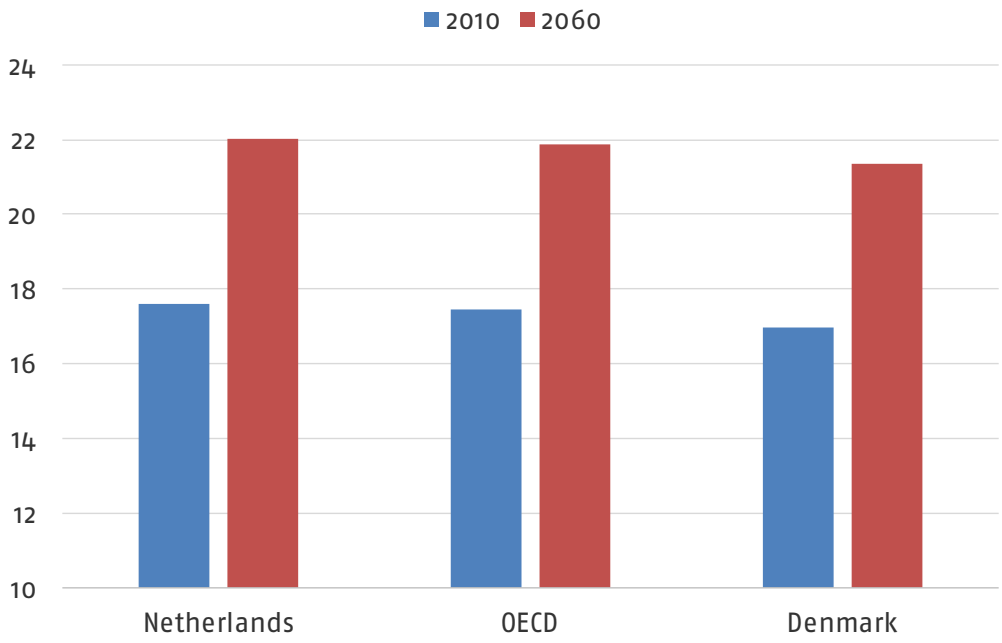
Source: OECD (2015)

Figure 7. Total private pension investments per country in USD million



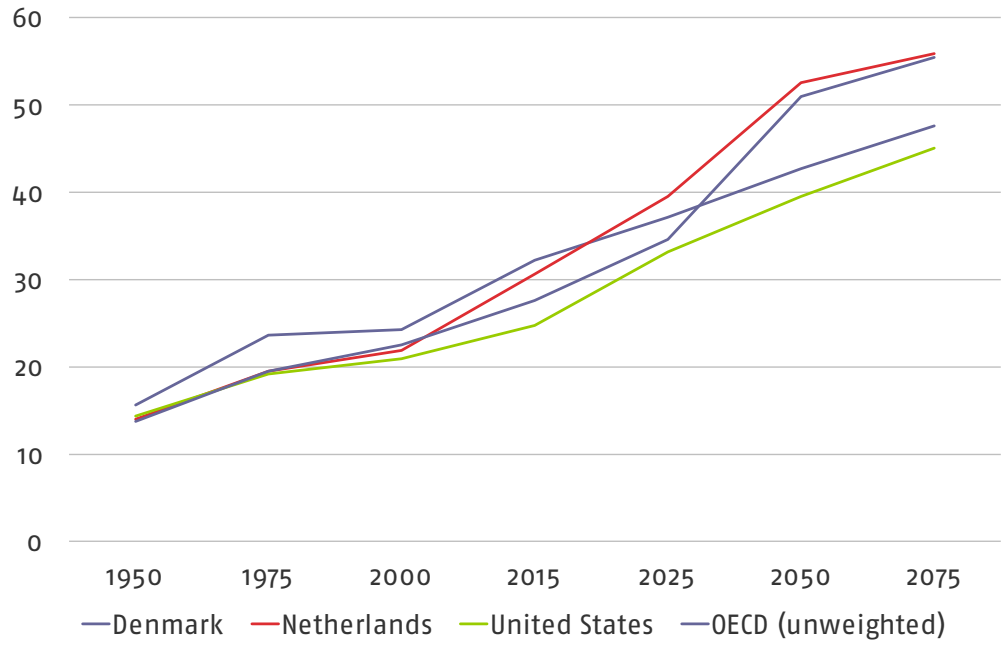
Source: OECD (2015)
Note: Total pension savings in the US: approx. USD 24 billion

Figure 8. Life expectancy at 65 (men)



Source: OECD (2015)

Figure 9. Old-age dependency ratios.
Number of individuals aged 65 and over per 100 working age individuals, defined as those aged between 20 and 64



Source: OECD (2015)

Netherlands (OECD, 2015), which is slightly above the OECD average of 17.5 years. Life expectancy at 65 in Denmark was slightly lower at 17 years. In 2060, life expectancy is expected to increase to 22 years, 21.9 years, and 21.4 years for the Netherlands, OECD, and Denmark respectively (see Figure 8).

The increase in life expectancy, coupled with a fertility rate that is expected to remain below 2 in both Denmark and the Netherlands, implies that old-age dependency ratios will increase. In Denmark, in 2015, there were 32 individuals above the age of 65 per 100 individuals in the working age, defined as those aged between 20 and 64. In the Netherlands, the corresponding number was 30.5. The old-age dependency ratio is increasing relatively fast in the Netherlands, although not much out of line with the rest of the OECD. These numbers are expected to increase to 47.6 for Denmark and 55.9 in the Netherlands (see Figure 9).

Impacted considerably by the expected increase in life expectancy and the consequences that this will have for developments in old-age dependency ratios, the legal retirement age will increase in both the Netherlands and Denmark. In the Netherlands, the retirement age will increase to 66 years in 2018 and to 67 years in 2021. In 2022, the retirement age will be set at 67 years and 3 months. From 2022

onwards, the retirement age will depend on the development in average life expectancy. An increase in the retirement age is announced at least five years in advance. Statistics Netherlands calculates the life expectancy of the Dutch. The goal is that retirees should receive a pension for an average of 18 years. Note that the retirement age discussed here applies for the first pillar pension, which is decoupled from the other pillars that apply a retirement age of 68 in 2018. In Denmark, the retirement age will increases to 67 years in 2022 (from 65 years today). The retirement age will then follow the life expectancy developments, as in the Netherlands. In Denmark, the aim is that the average expected retirement period should be 14.5 years. The retirement age can be adjusted every fifth year (depending on the development in life expectancy). In 2015, it was decided that the retirement age will be 68 years in 2030. It is expected that the retirement age will be increased by one year every fifth year from 2035 to 2050 (Danish Ministry of Finance, 2017). This means, for instance, that the expected retirement age will be 72 years in 2050. Based on the Dutch life expectancies of 2017, this would mean a retirement age of 70 years and 3 months in 2050 in the Netherlands.

What does the high current pension savings level, along with increasing life expectancy, imply for replacement ratios? The replacement ratio is the ratio between gross income after retirement (including the first and second pillars, see below) and gross income before retirement. The replacement ratio is relatively high in the Netherlands and Denmark compared to other OECD countries. It is about 91% and 71% for the Netherlands and Denmark respectively, while the European average ratio is about 54% (OECD, 2015). The OECD overestimates the Dutch rate since the underlying assumption is that a fictitious person receives the median income throughout his or her working life of 45 years (Knoef et al., 2015). However, pension income is in reality likely to be lower for many due to an incomplete working history. Traditionally, the ambition was to have a pension income of about 70% of the last earned gross wage, but this was changed to 70% of the average earned salary over those years that contributions were paid to the Dutch DB plans. In Denmark, there is no official goal of a fixed replacement ratio.

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